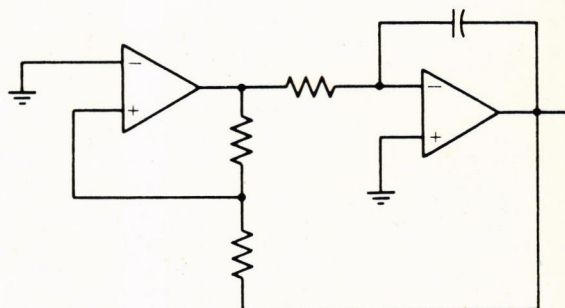
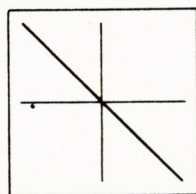
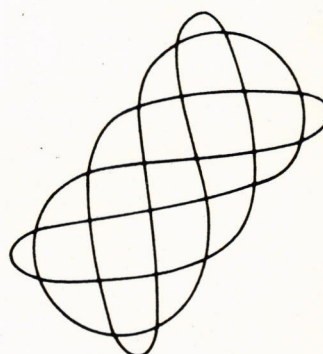
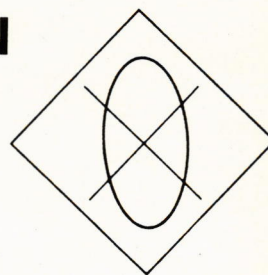
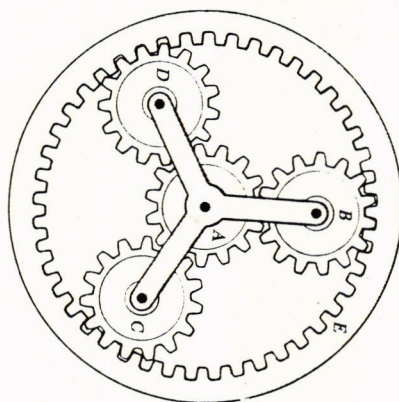
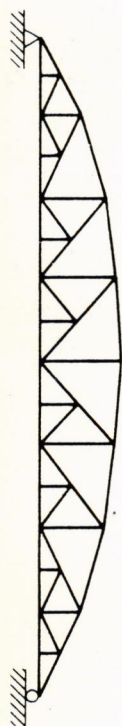


# MECHANICAL

**LAUNCH YOUR CAREER IN AN  
ENGINEERING FIELD**



# MECHANICAL CIVIL

Established 1942

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## Career Service Center Overview

*Excerpts for this article were taken from the "Guide To Career Services 1988-1989" produced by the Career Service Center at George Washington University.*

After spending four torturous years in undergraduate Engineering, every engineering student hopes to land a well paying, interesting job as soon as they get out of school. But, far too few engineering students take advantage of the Career Services Center that G.W. provides.

The Career Services Center's purpose is to promote effective career planning and decision-making skills by GWU students and alumni, and to teach job search skills and to facilitate contacts between students, alumni and prospective employers. For those students who have not yet discovered what the Center has to offer, here is a brief overview of what the Career Service Center offers the engineering student.

The CAREER RESOURCE LIBRARY(CRL) provides a large number of employer information references, job hunting guides, career field descriptions, salary surveys, and self assessment/career planning books and videotapes. These resources are valuable during every stage of your job hunting process. Visit the Career Center and look at the "Guide to Career Services" for a complete listing of the references available. Some especially useful to the engineering student would be 1988 Peterson's Engineering, Science and Computer Jobs, High Technology Careers, and Washington '88.

Full-time, Part-time, Summer jobs, and Internship listings are provided in the CRL, these can be used on a self serve bases. The job listings are organized by occupational/career related headings. Full descriptions and required qualifications are included in the listings.

Selected full-time positions are highlighted on the Center's 24-hour telephone Jobline(994-8636). The recording is changed three times a week. Call Wednesday or Thursday for job news in engineering, computer sciences, and other applied sciences.

There are number of recent acquisitions to the videotape library that would be interesting to the engineering student, including "The Technology Centers of Booz Allen and Hamilton, "John Hopkins University Applied Physics Lab, National Security Agency- "NSA: A Job that Counts".

A CREDENTIALS SERVICE is provided by Career Services to support students applications for employment and graduate/professional schools. A student may initiate a file that includes references, transcripts, resumes and other appropriate documents(involves a fee). A credentials file is required for participation in campus interviewing and the resume referral service. Several hundred employers visit the campus each year to conduct preliminary interviews. If you are within one year of graduation and have started a credentials file with the Center you are invited to sign up for appropriate interviews.

Representatives from a number of well known engineering and computer

science firms come to the center both fall and spring for ON-CAMPUS INTERVIEWS. Read more about this program in this issue.

**RESUME REFERRAL SERVICE** this allows your resume to be referred to appropriate prospective employers. This is a computerized system that provides direct referral of candidates resumes. When a student submits a completed Candidate Data Form a file is created, and the students name is added to the database. When employers make requests to receive resumes from the Career Services Center, the staff searches the database and pulls resumes, matching employers' job requirements with candidates' career interests and location references. The personal data file will remain in the system for one year unless the career center is notified that the student is no longer seeking employment. It is the students responsibility to make sure that there is a sufficient number of resumes in his file at all times. A Candidate Data Form is available in the "Guide to Career Services."

A new career planning tool is now available at the Career Services Center. RESUmania is a computer software system that enables users to design, typeset, print, and change their resumes at any time, instantly. The newly acquired system is available in the Center during regular hours.

**WORKSHOPS and PROGRAMS** are held at the Center to assist the student in developing effective career decision and job-search strategies. Some of the programs offered are "Job Search Strategy", "Letters and Resumes",

"Effective Interviewing", and "How to Make Career Decisions." A program schedule can be found in the "Guide to Career Services."

CONSULTING is another invaluable service available at the Career Center. A consultant is there to guide you specifically as a student of engineering or computer science. Lucy Hoffman, an assistant director at the Center is the liaison to SEAS. Call Career Line (994-9225) each week for a recording of scheduled consulting hours.

A current, typed resume or cover letter draft may be submitted to the Center to be critiqued within a 48-hour period by career consultants as a part of the RESUME CRITIQUE SERVICE. If you need more help with your resume try the resume writing workshop, or read the "Guide to Career Services" for more tips.

Following participation in the "Effective Interviewing" workshop and/or use of CRL resources, simulated interview or MOCK INTERVIEWS are videotapes by career consultants and are available on an appointment basis.

The COLONIAL CONNECTION is an alumni network of contacts maintained on a computerized database. Alumni and students interested in referrals to Colonial Connection participants, meet with career consultants during scheduled walk-in-hours to discuss career objectives prior to participation in the program.

Lastly, do not forget CAREER WEEK '89! This year Career Week will be held February 6-10. It promises to provide stimulating career information to students and alumni at any career stage. This will be the seventh annual Career Week coordinated by The George Washington University Career Services Center. Through

panel presentations, lectures, open houses, group discussions and a Career Fair, students and alumni have the opportunity to explore career fields, learn strategies for obtaining jobs and discuss current career trends with experienced professionals. More than forty programs are designed around three themes, each corresponding to a different stage in the career planning process.

Programs of special interest to SEAS students already on the schedule are "Careers in Artificial Intelligence, Wed, Feb 8, 7:00 to 8:30 PM, "Hints from the Experts: Finding a job in Operations Research", Feb 8, 7:00-8:00 PM, "Programming Your Computer Career", Feb 8, 5:10-6:00 PM, "The Consulting Perspective", Feb 9, 12:10-2:00 PM, and "Networking Into Telecommunications", Feb 8 6:00-7:00 PM.

Also of interest are the following presentations, "Stressless Job Searching", Feb 7 12:10-1:00 PM, "When to Tab Into the Executive Search", Feb 8 12:10-1:00 PM, "Employer Perspective: The Other Side of the Desk", Feb 8, 12:10-1:00 PM., "Effective Communication", Feb 8, 5:30-6:20 PM, and "Manana: Procrastination and the Job Hunt", Feb 9, 2:10-3:00 PM.

The CAREER FAIR hosting over 50 employers will be held in the Marvin Center Ballroom on Thursday, February 9. A complete Program Schedule for the week's events will be available from the Career Services Center, Academic Center, suite T 509, in January 1989.

Please stop by the Career Center to see for yourself what valuable tools they offer. The Career Services Center is open 8:30 am to 7:00 pm, Monday through Thursday, and 8:30 am to 5:00 pm on Friday.

Career Line ..... 994-9225  
JOBLINE ..... 994-8636  
Career Resource Library ... 994-6496  
Employer Relations ... 994-8633  
Credentials ..... 994-8634



Courtesy of Mohab Akhnoukh

Lucy Hoffman is the Assistant Director of the Career Service Center and is the CSC liaison to the School of Engineering and Applied Sciences. As the liaison to SEAS, she serves as the primary CSC contact for the SEAS students, alumni and faculty. Ms. Hoffman is a University of Delaware graduate, where she received her Masters of Education in College Counseling/Student personnel Administration in June 1985 and her Bachelor of Science and Bachelor of Education in Business Education in May 1980. Contact Ms. Hoffman in the Center at 994-6495 for any SEAS related information or career consulting.

### Career Center Orientation Activities January 1989

Wednesday, January 11  
7:15 - 8:15  
Orientation to Career  
Services for SEAS Students

Thursday, January 12  
7:30 - 8:30  
Orientation to Campus  
Interviewing

*Special thanks to Anne Scammon, the Public Relations Coordinator at the Career Services Center, for her invaluable assistance in putting together this issue featuring the Center.*

# DESIGNING YOUR RESUME

## *(Excerpts from the "Guide to Career Services 1988-1989" at the George Washington University)*

### **Purpose**

A resume and cover letter will assist you in obtaining an interview - not a job. Resumes present a job seeker's background to potential employers and include skills, experiences and qualifications related to the hiring needs of employers. It stimulates employer interest in an applicant and serves as a screening device to select candidates for interviews. A resume is personal and creative. It provides an opportunity to highlight assets and summarize relevant information.

Resumes not only outline employment background and qualifications, but reflect overall career progress. The most effective resumes are developed by individuals who have assessed their personal and professional values, and targeted their job search strategy.

### **Content**

- \* Present your academic achievements.
- \* List grade point average, if impressive.
- \* Mention relevant term papers, research assignments, or coursework under "Educational Highlights."
- \* Include extracurricular and volunteer activities.
- \* Include internships in "Experience" section, or under a separate "internship" section.
- \* List any part-time and summer jobs. Employers are impressed with your willingness to work.

\* Willingness to travel or relocate, or date of availability are optional.

\* Extensive expertise or certification in a particular or related skill could merit a section of its own: "Languages," "Travel," or "Computer Skills."

\* Use "references Available Upon Request," to conclude the resume.

### **Constructing Your Resume**

\* Begin your resume with your name by capitalizing or using bold type.

\* Include street address, city, state, and zip code.

\* Include phone number(s) where you can be reached weekdays, 9-5. Designate your home phone with an "H", and work number with "W".

### **Career/Job Objective**

You may want to consider using a career/job objective in your resume. the objective communicates to the employer what you desire in a position, what type of organization you are targeting, and can include which skills you want to use in performing the job. A good objective includes:

- type and/or level of position,
- type and possible size of organization, and
- skills to be performed.
- options:
  1. Interest areas
  2. Types of people/products/services
  3. Purposes to accomplish
  4. Areas of knowledge

### **Qualification or Experience Summary**

A brief summary of qualifications can condense an extensive background by emphasizing experiences and qualifications in brief phrases. The qualifications summary is

accomplishment-oriented and provides an overview of your work experience. A summary is optional and most appropriate for someone with substantial experience or for someone who is changing careers and wants to demonstrate transferable skills.

### **Education**

\* Start with your most recent degree or the program in which you are currently enrolled. List other degrees or relevant education in reverse chronological order.

\* Highlight your degree by using bold type, capital letters or underlining.

\* If the degree is relevant to your job objective, begin with degree and emphasis, followed by university, locations of university, and date of graduation or anticipate date of graduation.

\* If your education relates to your objectives, and within the past three years, it should be the first section. If not, education should follow the work experience section of your resume.

### **Educational Highlights**

Consider listing relevant coursework under the appropriate degree. An alternative to highlighting courses is to list the skills and knowledge acquired through important courses and research. You may also describe design projects.

### **Describing Your Experience**

\* Do not use personal pronouns.

\* Make the resume as verb-intensive as possible.

\* Use short sentences or concise phrases.

\* Describe short sentences or concise phrases.

\* Describe specifically what you have accomplished. Do not describe the organization or the context or your experience.

- \* Avoid uncommon abbreviations.
- \* Use the vocabulary of the field to which you are applying.
- \* Refer to specific projects with measurable results.

### Ten Common Resume Mistakes

(Courtesy of Tom Jackson's "The Perfect Resume")

1. Too long — preferred one page.
2. Disorganized — hard to follow.
3. Poorly typed and printed — looks unprofessional.
4. Overwritten — takes too long to say too little.
5. Too sparse — gives only bare essentials of dates and job titles.
6. Not oriented for results — does not show what the candidate accomplished on the job.
7. Too many irrelevances — height, weight, marital status.
8. Misspellings, typographical errors.
9. Tries too hard — fancy typesetting and photographers.
10. Misdirected — no accompanying cover letter.

The Career Service Center offers resume critiquing with career consultants. The 48-hour resume and letter critiquing service provides an opportunity to receive feedback on your employment materials. The Center offers a "Letters and Resume" workshop on a regularly scheduled basis.

— compiled by Martin Loui



## Introduction to On-Campus Interviewing

Any SEAS student at George Washington University who does not take the time to participate in the On-Campus Interviewing Program at the Career Services Center, is missing a great opportunity to get ahead of his peers in the job search. If you are planning to get a job when you graduate how can you miss this opportunity to make contacts with a lot of well known engineering and technology organizations across the United States?

Students and alumni within one year of graduation from a degree program at G.W. are eligible to participate. Campus interviews are conducted for screening purposes by organizations typically offering entry-level positions. The following are the steps to take to participate in the program.

**STEP 1: Start a Credentials File** To participate in campus interviewing, candidates are required to register with the Center by activating a credentials file. Requests for interviews from candidates who have not registered with the Center will not be honored.

**STEP 2: Study the Sequence of Sign-Up Procedures** Each fall and spring semester, the Career Services Center sponsors nine or ten weeks of campus interviews, which are divided into five color coded sessions. The first session is BLUE, the second GOLD, the third GREEN, the fourth PINK, and the fifth PURPLE. The separate sign-ups for each session actually begin three weeks prior to the session. Therefore, as the chart illustrates, candidates may only submit requests for one session at a time, and only during the days designated.

**STEP 3: At the beginning of each fall and spring semester, a brief preliminary list of interviewing organizations is published. The schedule is printed in this issue. This list identifies the organizations which have confirmed interview dates. Since additional companies will be included in the program at the semester progresses, visit the Center to obtain the most up-to-date list of interviewing organizations in the "Campus Interview Bulletin", details regarding their requirements are not included on this list. The CIB features companies not included on the Preliminary list as well as specific requirements and position listings.**

Every other Monday, a detailed color-coded schedule is released. These schedules identify the interview dates, positions available, and candidate requirements for organizations visiting during the corresponding colored sessions.

**STEP 4: Submit Requests For Interviews** Color-coded interview request forms correspond to each colored schedule and session. Request forms are accepted Monday through Wednesday, 8:30 am to 7:00 pm, and Thursday until 5 pm, three weeks prior to each session. There will be no exceptions to this deadline. See the Guide to Career Services for more details.

**STEP 5: Receive Results** The Center will send candidates' interview appointments to their local address via first class mail. \* Late requests for interviews will be accepted on the Wednesday and Thursday preceding a two-week interview session, from 8:30 am to 7:00 pm. Candidates should check the Campus Interviewing bulletin board in the CRL to identify organizations which still have openings and submit a late request form. Times will be assigned on the spot.

# Preliminary List of Interviewing Organizations

## Spring 1989

2/6	<b>General Services Admin.</b> Government Agency Electrical Engineers	2/28	<b>Magnavox</b> Defense Contractor Electrical & Mechanical Engineers
2/7	<b>ICS Information Technologies</b> Software Development Consult. Systems & Programmer Analysts	3/1	<b>Internal Revenue Service</b> Government Agency Economists, Comp. Systems Analyst
2/8	<b>Motorola</b> Electronic Micro, Research & Development, & Manufact. Co. Japanese Foreign Nat. only	3/1	<b>Science Applications Int'l Corp.</b> Government Consulting Civil Engineers & Environ. Scientists
2/8	<b>GEICO</b> Insurance Systems Programmers	3/2	<b>Kaiser Engineers, Inc.</b> Technical Consulting Firm Civil, Mech., Elec. Engineers
2/9	<b>CAREER FAIR '89</b> 3rd MARVIN CENTER BALLROOM 4:00 p.m. - 7:00 p.m.	3/2	<b>Telecommunications Technic Corp.</b> Telecommunications Consult. Firm Elec. Engineers & Software Enginee
2/14	<b>PIRG</b> Public Interest Research Group Various Positions	3/3	<b>Omni Communications Co.</b> Communication Services Co. Sales Reps.
2/16	<b>IBM</b> Computer Services Corp. Computer Scientists & Elec. Engineers	3/3	<b>NCR Corporation</b> Engineering & Manufacturing Systems Engineers
2/16	<b>ADP</b> Computer Services Corp. Sales Interns	3/6	<b>Bureau of Labor Statistics</b> Government Agency Economists, Computer Specialists
2/16	<b>NASA-Goddard Space Center</b> Government Agency Engineers	3/7	<b>ICF, Inc.</b> Environment/Energy Consulting Research Assistants
2/21	<b>Systems Res. Application, Inc.</b> Information Systems & Telecommunica- tions Consulting Programmers, System Analysts, & Economists	3/7	<b>National Security Agency</b> Government Agency Engineers & Linguists
2/22	<b>Naval Research Laboratory</b> Government Agency Computer Systems Engineers	3/7	<b>Applied Signal Technology</b> Electronic Defense Co. Software Engineers
2/24	<b>Micros Systems, Inc.</b> Electronic Systems Software Programmers	3/8	<b>McDonnell Douglas Astronautics</b> Aerospace Technological Services Engineers
2/27	<b>Navy Engineering Officer Prog.</b> Government Agency Engineers, Nuclear Power Plant Managers & Instructors	3/8	<b>Technology Service Corp.</b> Defense Contractor Corp. Various Positions

3/9	<b>Logicon</b> Technical Consulting Firm Various Technical Positions	3/23	<b>MCI</b> Telecommunications Co. Management Information Systems Trainees
3/22	<b>U.S. Navy</b> Government Agency U.S. Naval Officer	3/23	<b>Computer Sciences Corp.</b> Software Services Corp. Associate Managers of Technical Staff
3/22	<b>ICF, Inc.</b> Environment/Energy Consulting Environment/Energy Consultants	3/30	<b>RCI</b> Defense Contractors Analysts, Engineers, & Programmers

#### SPRING 1989 INFORMATION SESSIONS \*

1/12	<b>Orientation To Campus Interviewing</b> features information essential to participating in the Spring 1989 Campus Interview Program. Career Services Center at 7:30 p.m.
1/24	<b>IBM's Information Session</b> for electrical engineering and computer science students only. Marvin Center room 413 at 7:00 p.m.
2/13	<b>PIRG's Information Session</b> , a public interest research group. Career Services Center at 7:00 p.m.
2/23	<b>AT&amp;T Bell Laboratories' Information Session</b> for system engineers. Career Services Center at 7:00 p.m.

\*Sign up in advance at the Career Services Center's front desk for information sessions.

### Interview Session Signup Schedule

Spring Semester 1989				
	Interview Session	Schedule Released	Deadline for Requests	Results Mailed
<b>BLUE</b>	<b>FEB 6—FEB 10 and FEB 13—FEB 17</b>	JAN 17	JAN 19	JAN 30
<b>GOLD</b>	<b>FEB 20—FEB 24 and FEB 27—MAR 3</b>	JAN 30	FEB 2	FEB 13
<b>GREEN</b>	<b>MAR 6—MAR 10 and MAR 20—MAR 24</b>	FEB 13	FEB 16	FEB 27
<b>PINK</b>	<b>MAR 27—MAR 31 and APR 3—APR 7</b>	MAR 6	MAR 9	MAR 20
<b>PURPLE</b>	<b>APR 10—APR 14 and APR 17—APR 21</b>	MAR 20	MAR 23	APR 3

# STEPS TO SUCCESSFUL INTERVIEWING

Transcribed by: Swati Patel

Believe it or not, interviewers want to hire you. Careful preparation and effective communication have a strong influence on the outcome of the interview. This article directs you through the processes that lead to successful interviews.

## Preparation:

The advantages of advance preparation for interviews are numerous. Naturally, if you know what you want to say ahead of time, you can usually articulate it more effectively.

— The first step in your preparation is to identify your skills, interests, and career goals before you arrive at the interview. A comfortable self-knowledge will help you answer the interviewer's questions about your goals and desired direction within that organization.

— The next step is to study your prospective employer. "One of the confidence builders to help gain control of the job interview is to have a thorough knowledge of the organization prior to the interview," advise Merman and McLaughlin in 'Out-Interviewing the Interviewer'. "Researching an organization means you will have to do a little digging. The purpose of research is to learn about the company's services, or products, the number of employees, the financial situations, competitors, problems, the management style and employee benefits. You need to scope them out to determine if they are the kind of organization where you would like to be employed."



— Impressions are formed during the first two to six minutes of the interview. Thus, what you wear can affect your chances. Dress should be appropriate for the organization with which you are interviewing. You should aim to convey an image of professionalism, authority, and competence.

— You may wish to carry a briefcase or a professional-looking notebook with your questions written in advance.

— Finally, be aware that interviewer styles vary widely, though most can be categorized as either 'directive' or 'nondirective'. Merman and McLaughlin's book is one of several excellent books providing insight on types of interviewers. The CSC Career Resource Library has these books on reserve.

## Arrival:

— Always allow ample travel time in order to be punctual. You should arrive 10 to 15 minutes before the interview.

## During the Interview:

— Expect to be nervous at the outset. Interviews most often begin with what's called an "open-ended icebreaker" — the

interviewer's invitation to "tell me about yourself." If you anticipate a lead-in opener, you will have ready answers and should find yourself beginning to relax.

— First interviews normally take about an hour (although most campus interviews last 30 minutes) during which time the candidate's accomplishments are reviewed. Generally 30% of the time is spent on the applicant and 70% on the organization and the vacant position. Under the best circumstances you should leave the interviewer with the impression that you can do the job. Often, however, you won't know whether you want the job until you've met with the company representative for the second interview.

— During a second interview, the time ratio changes to 50% on the applicant and 50% on the vacant position. This will be a more detailed session in which the candidate can ask pointed questions about the specifics of the job. (See "The Second Interview" in this article.) Interviewer and candidate communicate both verbally and nonverbally. To build a good rapport you should speak clearly, listen closely, and show by gestures and facial expressions that you are receptive to the interviewer's thoughts and questions.

— In answering questions, pause to give yourself time to compose an answer that is concise but thoughtful.

— If you feel you haven't communicated your reply clearly,

try again until you are sure that your message has been received correctly.

— Feel free to refer to your notes in answering questions. Listening to the interviewer is as essential as speaking honestly and forthrightly about your abilities.

— Concentrate on what is said rather than how you are doing, and you will most likely create a good impression.

— Listening to the interviewer's questions and statements will help you formulate your responses and obtain a better understanding of the organization's views and work environment. The interviewer may give you his first sign that the interview is coming to a close when he or she asks if you have any further questions.

— At this time you should ask questions that will reflect both the insight you've gained from the interview and your professional values. Be careful not to ask something the interviewer answered earlier, although this is the perfect time to ask for clarification on anything you're not sure you understood.

— You might choose to bring up one or two additional strengths or skills that further match you to the organization — again, brief statements only.

— If, by the close of the interview, it has not been mentioned when a decision will be made on the selection of a candidate, ask the interviewer directly. Establish a date for your next communication.

— Thank the interviewer, shake hands, and make your exit.

— Promptly send a thank you letter.

### **The Second Interview:**

As part of the hiring process, a second interview is usually held. It's the final step before a job offer or rejection is given. The first

interview is generally a screening interview, even when it is held at the offer of a long distance visit is extended. While most organizations require receipts only for travel and rooms, it is a good idea to obtain receipts for meals and any other related expenses in the event that they are needed. As to how much to spend for meals and other expenses, the best advice is that of moderation.

— Who does pay? - Most organizations in the business and industry sector pay for any expenses, but most governmental and educational organizations do not. A second interview is frequently required, however, by governmental and educational organizations before hiring can take place.

— Evaluation - Throughout the second interview, evaluation will be taking place. Each person who meets you, even through an informal introduction, will evaluate you for hiring purposes.

In some cases, salary will be discussed at the second interview. Most frequently, organizations wait until the designated notification date to extend offer letters with the salary and starting date or, unfortunately, to issue the rejection letter.

A final word on the second interview — take plenty of resumes. Most of the paperwork will already be available to the staff, but some firms are not that well organized. It is impressive to see that an applicant is so well prepared as to have extra resumes. Don't offer resumes, though, unless asked.

### **Follow up:**

Be sure to write a thank you note to your interviewer. If you met with more than one person, which is fairly standard during the second interview, send a thank you note to each person.

— This letter is an opportunity to add any important information in support of your application that you may have neglected to

mention or emphasize in the interview.

— If you do not hear from the employer by the specified notification date, feel free to call the organization and ask about the status of your application.

### **The Outcome and Your Response:**

Most offers are made in writing by the firm with a starting date and salary commitment. Some are made over the phone or in the second interview.

— It is always necessary to respond in writing to an offer. In accepting, send a letter as soon as possible. If the offer being accepted was made over the phone or verbally in the interview, repeat the offer in writing as it was understood.

— You may receive an offer while waiting to hear from other firms. Delays may be gained by asking the employer making the first offer whether a time extension is possible.

— If you are going to refuse an offer, please do so promptly. Use good public relations when refusing an offer, because you might find yourself wanting to work for that firm in the future. In addition, your new organization might be doing business with that firm, and you will be meeting many of the same people.

For further assistance on successful interviewing, the CSC, the Career Services Center in the Academic Center, has several other resources to assist job seekers with interview techniques, including "Effective Interviewing", a 1 1/2 hour workshop offered weekly. Check the program schedule in the Career Resource Library for details.

# MECHANICAL ENGINEERING: SUGGESTIONS FROM EXPERIENCE...

**by: Eric Takamura**

While one completes his schooling and comes to the point in life where the future and what a properly planned course could bring, one realizes that there are many questions that are left unanswered. The transition from the world of a student to someone contributing their part in the job market could be a rather difficult process, but when a learning person seeks help, he asks the experienced . . . and I did just that when I talked to two George Washington University alumni, Jeff Meeker and Sean Walsh.

Jeff Meeker, an 83' Graduate of G.W. in Mechanical Engineering (ME), who was ranked 2nd in his class, presently works for Physics International in Fair oaks, Virginia. His job consists of working with finite element codes developed in the late 70's, which is called Physics International Scientific Codes and Engineering Service, PISCES.

According to Jeff, it is important to have a broad curriculum when pursuing one's degree, mainly if it is a Mechanical Engineering Degree. He states that this is especially true if a student is not exactly sure of the specific concentration in which he would like to work. In this way, the student gets a general exposure to every aspect of the Mechanical field, thus better preparing himself for the job world. Two suggested course selections by Jeff are:

ME 285 — This course gives one a general exposure to finite element codes, which are being used so much more in today's job field, thus, making this course a good technical elective.

EAD 206

— This course in Engineering Administration deals with the business side of Engineering, as in such areas as cost effectiveness and management.

Overall though, when choosing one's curriculum, it is important " . . . to have knowledge of other stuff ", whether the student is in a specific concentration or not. This then allows him to keep up with "what's happening in the working world ", thus, to better prepare himself.

After graduation, Jeff suggests that one take the Engineer in Training (EIT) examination. This should be done as soon as possible, so that all newly acquired knowledge would still remain fresh and be of use for the exam. Also, if the student chooses to continue his education from the BS to the MBA level, he should recognize that many universities look for work experience as well as grades. In fact, in order to gain much needed experience, Jeff suggests that one participate in a Co-op program.

Another program that is thought to be very helpful for later experience is an Externship Program. At one time, the program existed at GW, but is no longer being offered. In an externship, a student spends a couple hours a day with a GW alumni that is presently working in the job field. In this manner, the student can get the feel of what the "front line " is like, and he or she gets to experience viewing the various aspects of any concentration. This vital experience may save the student a lot of time in decision making

towards his or her area of ME concentration. Because of the many benefits gained from working with professionals, Jeff suggests, that if it can be done, this Externship Program be reinitiated in GW's options of programs offered to their engineering students.

Overall, Jeff felt that G.W. was a sound institution for one's studies, and in fact, he is finishing his Masters there. However, the one problem that he found with GW was the lack of test facilities — at least in the ME department. He believes that one should have the opportunity to use and experiment more in the laboratory, thus, acquiring experience and familiarity of the engineering field before entering the job world.

In summary, if there was one statement to be made, Jeff believes that when a person goes into the job market he must have the " . . . ability to study and learn ", for often, one finds himself placed in a situation which he knows nothing about and is forced to learn about it. This ability of learning is most often recognized through grades.

Sean Walsh, a 76' graduate of GW, who earned a BS in ME, is a Lieutenant Commander in the Navy. He currently acts as an Engineer Duty officer in the field of ship design.

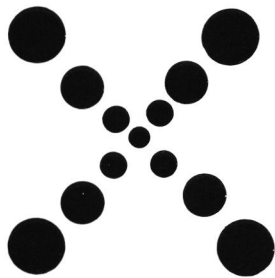
Sean, like many others, believes in a well rounded education. Being a former GW student and active member of the alumni board, he believes that GW has kept their curriculum up to date and current with the needs of the students as they pertain to the ever changing

demands of the job world. However, there are a couple of suggestions Sean would like to make. One is to have more part-time instructors who actually work in the job market. In this way, students are in direct contact with the source of experience.

Another thing that he remembers from his student years is that many people who could have been good engineers were turned off with the idea of Engineering. This was due to the over emphasis on Math and Physics as being the soul of Engineering rather than the tools. He believes in order to offset this idea of Science and Math being so important, there should be more project type courses including labs to give one the "flavor" of actual engineering. Realizing the probabilities of this action ever being taken, all one can say is . . . do not get discouraged.

Before entering the job market, Sean suggests that one should obtain experience through every means possible, such as co-op for experience. If co-op is not possible, then at least one should pay attention to what is happening around him, especially, in the politics of the work world, and in the governmental world, for they often go hand in hand. In this way, the person can preview his or her future. With this in mind, a student could realize the real advantages of attending GW, since it's located in the heart of the political system.

In short, "try to take a broad view of everything . . . keep an eye out in other fields . . .", because one just might be able to use some of that knowledge in his or her own field.



## ***What is Electrical Engineering and Computer Science?***

*(The following are excerpts from the GWU Bulletin for the SEAS.)*

Electrical engineering is concerned with the generation, transmission, control, and utilization of electricity as a source of energy and a medium of communication. Electrical engineers design generators that produce electrical energy, transmission networks that carry this power to homes and factories, and motors that use it to drive machinery. They harness electromagnetic radiation to produce radio waves for the propagation of radio and television signals and the transmission of information via satellites, and design the electronic circuits used in communications equipment and computers. Electrical engineers are now developing instrumentation to assist the medical profession in understanding the causes of disease and to aid in enhancing the quality of and prolonging life.

Electrical engineering is a discipline in which practical, theoretical, and scientific aspects are integrated. Analysis, synthesis, and design go hand in hand. Because the world's primary energy sources are limited, electrical power is an important resource. The production of electricity from nuclear power and control of nuclear power plants is a growing concern to electrical engineers, and they are involved in research to produce electrical energy directly from solar power.

The GWU Electrical Engineering option also includes two options, i.e., computer engineering and premedical engineering. Computer engineering is a developing discipline that combines electronic design, programming of computers, and mathematics into a comprehensive area. It involves the design computers for scientific and business applications, and the use of hardware and software for minicomputers and large-scale computing systems.

Premedical engineering prepares an individual for application to a medical school with a B.S. in engineering. Sufficient background is gained in various allied health fields and in the research and development of new electronic equipment used in medicine.

Computer science is the study of the computer's physical attributes, or hardware, and the methods of its use, or software. Widespread use of the digital computer has caused changes in virtually every area of human endeavor involving data generation, collection, analysis, reduction, and display. Business, economic, legal, educational, scientific, military, political, and humanitarian organizations have all benefited in some way by using computers. Careers are available in every area related to computer science, including designing, testing operating, installing, programming, maintaining, instructing, and buying and selling computers and related equipment.

# HDTV Creates a Sharper Image for Television of the 1990's

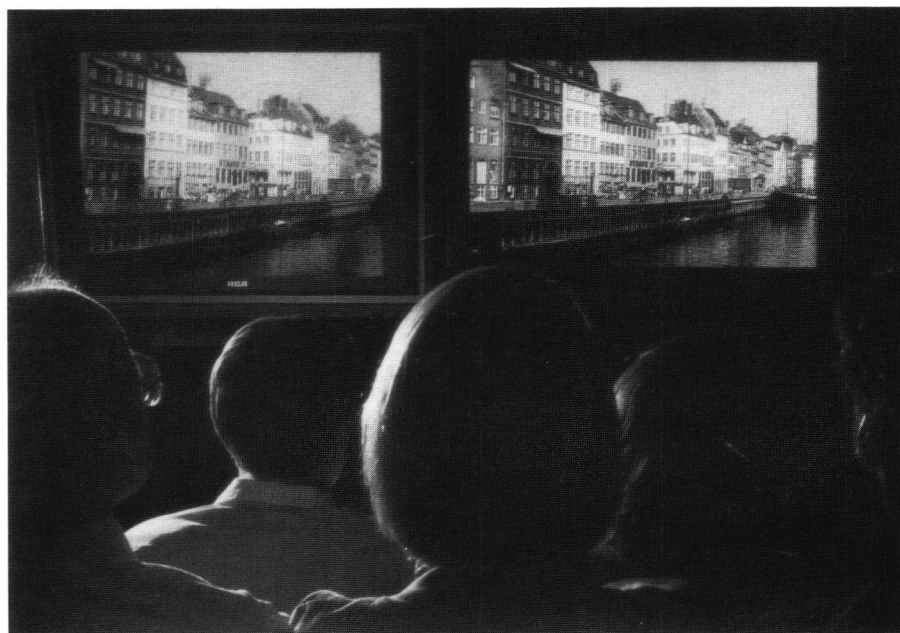
by **Taher Farkhondeh**

The Cardinals-Phillies game of August 4, 1988 will be remembered for some time by those who watched at St. Louis's Fox Theatre. Southwestern Bell Telephone broadcast three innings of the game live via High-Definition Television (HDTV), over fiber optic lines linking Busch Stadium and the theatre, five miles away. Four hundred fans at the theatre watched the doubly sharp HDTV demonstration on a 28-foot screen, side-by-side with a live standard format transmission (NTSC). For better comparison, Sony HDTV and GE NTSC cameras had also been placed side-by-side at the stadium. It was the first live HDTV sportscast in the United States.

## What is HDTV?

Imagine television with a picture as sharp and clear as 35 mm films and sound as good as a digital audio disk. With this kind of picture and audio quality, HDTV will be the next standard for television transmission and reception. NHK, the Japan Broadcasting Corporation, has been the worldwide pioneer in HDTV for many years. NHK's studio production standard requires 1125 scanning lines per frame, sixty fields per second, two to one interlaced scanning, and a sixteen to nine aspect ratio. Aspect ratio defines the ratio of width to height ution, in comparison with the existing American Television Standard's 525 lines. Meanwhile, the 1125 lines for higher resolution requires a higher bandwidth. NHK will solve this problem by launching the BS-3 satellite for direct-broadcast-satellite HDTV transmission in 1990.

The standard that NHK will use to transmit by satellite will employ Multiple Sub-Nyquist



*The sharpness of HDTV transmission seen on the right hand screen, can be compared with the TV transmission presently used by television networks on the left.*

Encoding (MUSE), a bandwidth compression technique derived from NHK's studio system. MUSE reduces the bandwidth requirement from 50 to 10 MHz. Then, the BS-3 satellite can send the signal on one transponder band with a power output of about 100 watts per channel. On the receiver side, the signal can produce a picture on an NTSC receiver if an adapter is used.

## U.S. and HDTV

Back in the United States, commercial television station operators are opposed to introducing HDTV to the consumer market. There are two reasons for this opposition:

1. By introducing HDTV through cable or satellite, the picture of commercial television would look bad by comparison. As a result, advertisers would switch to other media, causing broadcast stations a loss of revenue.
2. Since the proposed HDTV system requires two channels, implementing this system

would force half of the existing television stations to go off the air in order to avoid co-channel interference.

## FCC and HDTV

FCC has moved into the fray, and two major points in the FCC decision are:

1. The implementation of HDTV in the United States should be downwardly compatible with the existing NTSC standard.
2. Terrestrial TV stations must be capable of broadcasting HDTV within the spectrum now allocated for television.

Some consequences of the FCC decision are:

1. The original HDTV system, which was developed by the Japan Broadcasting Corporation, cannot be used in the United States.
2. As stated before, the major concerns of the commercial television station operators can be solved by the FCC decision.

The FCC decision which requires HDTV systems to be

downwardly compatible with the current NTSC has given some tough technical challenges to the United States television industry. It is easy to see the main problem: sending four times as much data in the band-limited channel is a real challenge.

### Technical Solutions in Making Room for HDTV

In response to the FCC regulations, the television industry responded with at least seventeen proposed methods of broadcasting HDTV in the United States. William F. Schreiber, director of the Advanced Television Research program at the Massachusetts Institute of Technology, Cambridge, Massachusetts, was one of those who responded to the FCC proposal for HDTV. He proposed a smart receiver as a key element for a bridge system. The smart receiver adapts itself to receive and decode NTSC signals, as well as signals from different proposed systems. Then, consumers can use the smart receivers for all purposes, for example, to receive NTSC terrestrial and cable broadcasts, to playback from NTSC VCRs and videodisks, and to receive advanced television signals as well.

Recently, NBC responded to the FCC Notice of Inquiry for the HDTV system. During the annual technical meeting of the Society of Motion Picture and Television Engineers (SMPTE),

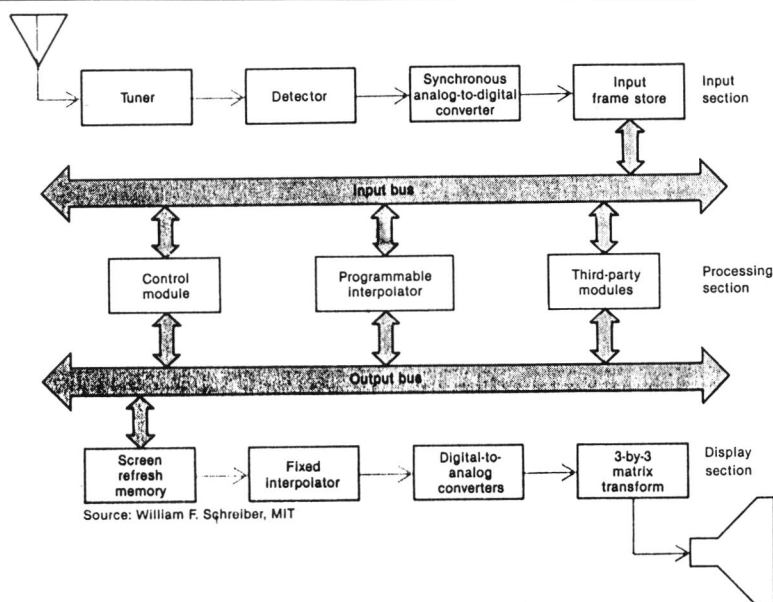
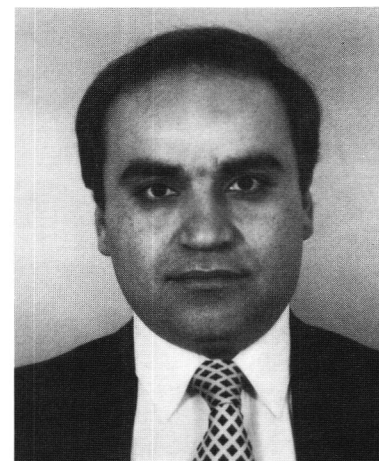


Fig 1. A possible architecture for a smart television receiver has a processing section(center) that is programmable by a small amount of digital data transmitted along with the signal. (Courtesy of IEEE Spectrum, pp 56-62, April 1988)

NBC made a surprise announcement. They showed their High-Definition TV format, called ACTV II (Advanced Compatible TV II). ACTV I was announced by RCA last year. ACTV II is expected to be better suited for FCC adoption, possibly putting two of the country's three major networks behind the standard. Hopefully, in the near future, high quality picture and sound will be transmitted into your home, at a low cost through HDTV.



Taher Farkhondeh received his BSEE from Tehran Polytechnic University, his MSEE from George Washington University, and he is currently working towards his PhD in Communications Engineering. He is a member of IEEE, and Eta Kappa Nu, the Electrical Engineering Honor Society. Beginning 1987, he has worked at XSI Corporation as a scientist engineer in the Research Department

Recently, he has designed new schemes for video enhancement, and a noise reduction post-processor. He has also taught Advanced Electronics and Control Systems at GW, since 1986. has also taught Advanced Electronics and Control Systems at GW, since 1986.

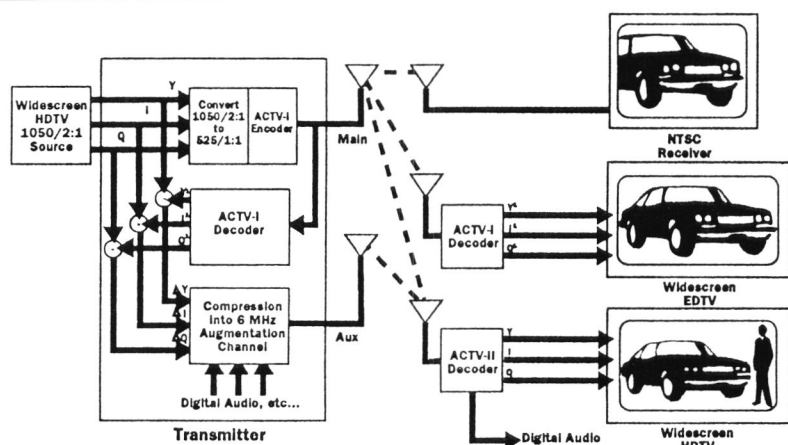


Fig 2. Advanced Compatible Television -II (Courtesy of Electronic Engineering Times, p 1, Oct 24, 1988)

# CIVIL ENGINEERING: From Windmills to Nuclear Power Plants!

by: Jeff Dion

The origins of civil engineering were discovered back in 1716 in the country of France. The earliest of the civil engineers were often self-taught craftsmen, stone masons, millwrights, toolmakers, and instrument makers. The first man to call himself a civil engineer was John Smeaton from France, when he introduced his own experiments with scale models of watermills and windmills to the government officials of France. In 1771, Smeaton founded the society of civil engineers in which their main purpose was to unite experienced engineers, entrepreneurs, and lawyers to promote the building of large public works, such as canals, railways and roads. A short time after, formal education in engineering science became readily available for men and women to pursue as a career. In 1824, Rensselaer Polytechnic Institute was the first university in the United States to offer civil engineering as a degree for a bachelor of arts. Since then, civil engineering has been found in mostly every college or university's curriculum in the world.

Today, the civil engineer has a lot more to worry about and plan than did the early engineers. The phases of the civil engineer can be divided into these three categories;

- 1) performing before construction,
- 2) performing during the construction period, and
- 3) performing after the construction has been completed. The first



*A modern marvel of Civil Engineering can be seen at California Center, a 47 story retail/office and hotel complex. The design of the core frame was aided by computer technology. (Courtesy of Civil Engineering, Oct 1988 ASCE)*

phase the civil engineer needs to perform before actual construction takes place is conducting feasibility studies. This is done because the civil engineer needs to know the negative and positive points of the potential project, as well as the economic support for the project. Next, the engineer must "site investigate", which means to test

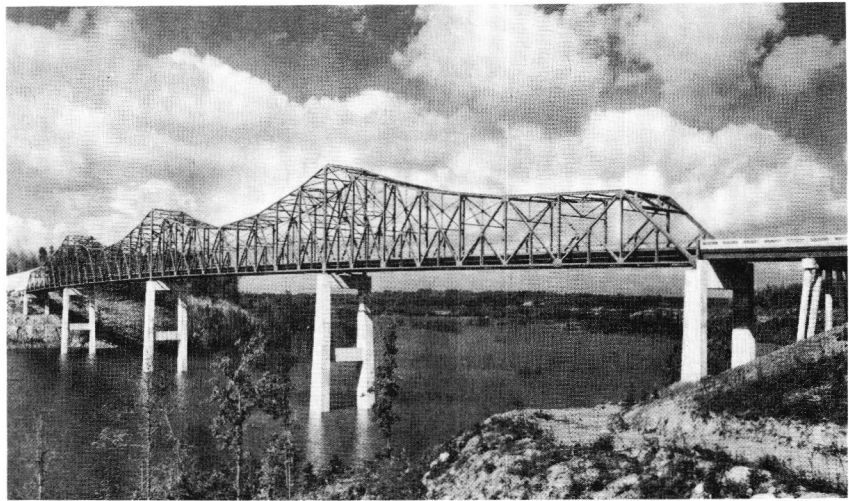
the stability and quality of the soil using soil mechanics. Studying the soil is a very important step before construction, because having unstable ground is a forewarning of possibly having an unsuccessful project. The last step before actual construction sets in is the design process, in which the civil engineer sits down at a drafting table and designs

his project on paper. The time it takes to design a project has been minimized by using computers to analyze the designs and to find mistakes that human error could have contributed to.

After the design is completed, the civil engineer then moves into phase two, which is construction. When construction sets in, the civil engineer takes the role of the consulting engineer, while the contractor undertakes to the finances, the design, the construction, and the commission of a project in its entirety. This leaves the consulting engineer as an engineer engaged by the contractor for advice, and for input to any variations introduced by approving a detailed drawing. The last phase (which is an on going phase) is that of maintenance and inspection of the projects that were build. Inspection is done for any possible ware and tare, that may cause hazards.

Where ever we look today, we see the result of civil engineering, whether it be the distribution of energy in the form of gas and electricity; the development of aircraft and airports; the construction of chemical processing plants; the development of nuclear power stations; and water desalination. Because of the vast areas in our every day life that civil engineering affects, there are different branches of civil engineering. They are the following:

- 1) Construction engineering — is the development of steel and concrete, including reinforced and pre-stressed concrete. Another objective of this type of engineering is looking for cheaper materials, which have the same characteristics of steel and concrete.
- 2) Transportation engineering — is very important in our major cities, and it deals with traffic studies, design of systems of roads, rail and air, and construction aspects of



*The use of trusses in construction is illustrated by Brown's Bridge in Gainesville, Georgia. (Courtesy of The American Institute of Steel contruction, Inc)*

transportation including pavements, embankments, bridges, and tunnels.

- 3) Maritime and hydraulic engineering — makes its impact on coastal cities, because having an efficient harbor is imperative in serving as the inlet for industrial plants, and the imports and exports of goods. Now, and in the future, with the expansion of world trade, and the use of larger ships (causing an increase in weight) a greater demand is made for deeper ports and waterways. This type of engineering is also used in India for high tech. irrigation systems to help in growing food.

- 4) Power engineering — is also a branch of civil engineering because, civil engineers have always played an important part in mining for coal and metals. These tasks consisted of boring out tunnels to make the resources accessible. But today, the design and construction of power stations have advanced, with the use of nuclear energy. Because of these nuclear power stations, a whole new field of design and construction has been added; including the ever so important, pre-stressed concrete pressure vessels for the nuclear reactor.

- 5) Public health engineering — the latest and most recent branch of civil engineering deals with liquid wastes and the ever so controversial, nuclear disposal. It also deals with all types of air and water pollution , and both large and small solid-waste disposal. This type of engineer plays an important role in the conservation and preservation of the environment, by primarily trying to design a mechanism that enhances, rather than damages or pollutes.

In conclusion, civil engineering encompasses those branches of engineering most closely related to the control and improvement of our environment and of the physical conditions of our lives. The curriculum offered here at George Washington University equips the student to begin a career upon graduation, to register as a professional civil engineer as required by law, and to pursue graduate study.



# PROFESSIONAL ENGINEERING: FIND OUT WHAT IT CAN DO FOR YOU!

**by Professor  
Derril C. Rohlfs, P.E.**

At the end of the Spring 1988 semester, a new student organization was formed at the George Washington University. This new organization is known as the student chapter of the National Society of Professional Engineers.

*Derrill C. Rohlfs is an Associate Professor and Director of the GWU Electronics Laboratories who received his undergraduate and graduate Electrical Engineering degrees at George Washington University. He worked for the Naval Research Laboratory, where he has received many honors and has written numerous papers relevant to Communication and Radar Systems. During his employment with NRL, he was also a part time EE instructor at GWU. Over the years, he has acquired interests in all fields of electronics, specializing in high power radars, circuits and communications. After being a full time instructor at GWU for the past 7 years, he says that teaching is most important to him and he would not trade it for anything. His teaching endeavors have resulted in his receiving the full time "Instructor of the Year Award" for 1985-86, honored by Eta Kappa Nu.*



COURTESY OF EULER UY

One of the objectives of this organization was to set up a review course for the Fundamentals Examination (EIT), a first step to becoming a Registered Professional Engineer. In the Fall 1988 semester, this goal was realized. The review course will begin January 21, 1989.

This endeavor raised many questions from the student body:

- \* What is professional engineer registration?
- \* Why is it required?
- \* How do I apply for registration?

This article is an attempt to answer these questions and to stimulate the student in becoming a Registered Professional Engineer.

## It's the Law !!!

The following is from the District of Columbia Code, 1981 Edition, Title 2, Chapter 23, Sections 2-2301 through 2-2318:

### \* Definitions (Section 2-2302)

"(2) The term 'professional engineer' shall mean a person who, by reason of his special knowledge of the mathematical and physical sciences and the principles and methods of engineering analysis and design customarily acquired by a prolonged course of specialized intellectual instruction and study and practical experience, is qualified to engage in the practice of engineering as attested by his certificate of registration as a professional engineer."

### \* Policy (Section 2-2303)

"In order to safeguard life, health, and property, and promote the public welfare, the practice

of engineering in the District of Columbia is hereby declared to be subject to regulation in the public interest. It is further declared to be a matter of public interest and concern that the profession of engineering merit and received the confidence of the public and that only qualified persons be permitted to engage in the practice of engineering."

### \* Practice of Engineering without Registration Prohibited (Section 2-2304)

"Any person engaged in or offering to engage in the practice of engineering in the District of Columbia shall submit evidence that he is qualified to practice and shall be registered as hereinafter provided; and it shall be unlawful for any person to engage or offer to engage in the practice of engineering in the District of Columbia, or in any verbal claim, sign, advertisement, letterhead, card, or in any other way, represent himself to be a professional engineer, or through the use of the title including the word 'engineer' or words of like import, or any other title, imply that he is a professional engineer, unless such person is registered under the provisions of this chapter."

Similar laws have been established in all the states and are administered by the state's Board of Registration for Professional Engineers. A person seeking to practice engineering must first be evaluated in his education, training, and experience before being accepted to take the two-part examination: the Fundamentals of Engineering (EIT) and then the Principles and Practice of Engineering (PE). All state Boards give the National Council of Engineering Examiners (NCEE)

examination except Illinois. The examination is given across the country on the third weekend of April and October.

### **Fundamentals of Engineering Examination (FE/EIT)**

This examination covers the basics of ALL the disciplines of engineering: chemistry, computer programming, dynamics, electrical circuits, engineering economics, fluid mechanics, materials science, mathematical modeling of engineering systems, mathematics, mechanics of materials, statics, structure of matter and thermodynamics. In many of the states and the District of Columbia, this examination may be taken just prior to or any time after the applicant's college graduation. One hundred and forty questions are given in the morning session, while seventy questions are given in the afternoon session.

### **Principles and Practice of Engineering Examination (PE)**

This examination may be taken after four years of tenure as an EIT. The engineering subjects that are covered are: Chemical, Civil, Electrical and Mechanical. The morning examination consists of questions to be answered in your chosen discipline, while the afternoon session requires questions to be answered in agricultural, ceramic, industrial, manufacturing, nuclear, petroleum, sanitary, structural and aeronautical/aerospace engineering. Local instructions are given at the time of the examination about the number of questions and the disciplines in which questions must be answered.

### **Exemptions from Registration (Section 2-2310)**

The following excerpt discusses exemptions from professional engineer registration.

"Nothing in this chapter shall be construed to affect or prevent the following:"

"(4) The performance of engineering work by any person who acts under the supervision of a professional engineer, or by an employee of a person lawfully engaged in the practice of engineering and who in either event does not assume responsible charge of design or supervision,"

"(5) The practice of engineering as a consultant, officer, or employee of the government of the United States or the government of the District of Columbia, while engaged solely in such practice for such governments,"

"(7) The practice of engineering exclusively as an officer or employee of a public utility corporation by rendering to such corporation such service in connection with its facilities and property which are subject to supervision with respect to safety and security thereof by the Public Service Commission of the District of Columbia and so long as such person is thus actually and exclusively employed and no longer: Provided, however, that each such public utility corporation shall employ at least one registered professional engineer who shall be in responsible charge of such engineering work,"

"(9) The construction or alternation of a building that does not cover over 1,000 square feet of ground area and does not have height of over 20 feet to the uppermost ceiling, or two habitable floors above a basement,"

"(10) The execution of construction work as a contractor, or the superintendence of such construction work as a contractor or superintendent, or the work performed as a salesman of engineering equipment or apparatus,"

"(12) The usual supervision of

construction or installation of equipment within a plant under his immediate supervision by a person ordinarily designated as supervising engineer or chief engineer or power."

### **Applications for Registration**

Applications for registration must be procured, executed, and submitted 90 days prior to the date of the examination. This requirement may vary with the different states Boards of Registration. The examinations in the Washington, D.C. metropolitan area may be taken in Virginia and Maryland, as well as the District of Columbia.

For District of Columbia, the Application for Registration may be requested from:

District of Columbia Board of Registration for Professional Engineers  
614 H Street, N.W., Room 910  
Washington, D.C. 20001  
Phone: (202) 727-7454

For Maryland, the Application for Registration may be requested from:

Maryland State Board of Registration for Professional Engineers  
501 St. Paul Place, Room 902  
Baltimore, Maryland 21202  
Phone: (301) 659-6322

For Virginia, the Application for Registration may be requested from: Virginia State Board of Architects, Professional Engineers, Land Surveyors and Certified Landscape Architects  
Department of Commerce  
Seaboard Building, 5th Floor  
3600 West Board Street  
Richmond, VA 23230-4917  
Phone: (804) 774-1301

Your certificate for the Engineer-In-Training, if issued in a state using the NCEE examination, will be honored in all the other states using the NCEE examination. Illinois is the only exception.

### **Examination Preparation**

The structure of the present

day four-year college curriculum does not cover all the disciplines for which questions are asked in today's Board of Registration examinations. It is highly suggested that the applicant prepare himself for the examination through self-study review or through formal review courses offered through out the country. A list of the available self-study review material may be obtained by request from:

National Society of Professional Engineers  
1420 King Street  
Alexandria, VA 22314  
Phone: (703) 684-2800

The local chapter of the National Society of Professional Engineers (NSPE) or local colleges may be contacted for review courses. The structured review courses are well worth the expenses involved.

#### Review Course at GWU

Arrangements have been made by the School of Engineering and Applied Science (SEAS) through the Department of Continuing Engineering Education Program (CEEP) to offer a Fundamental Examination (EIT) review course each Saturday morning from 9:00 AM until 12:00 noon beginning January 21, 1989. Ten sessions will be held to cover the necessary material. Allowing for snow days and holidays, the session is to end April 1, 1989. Tuition is free to all GWU engineering seniors and graduate students. A nominal tuition fee will be involved for other students and interested persons. All attendees will be required to pay for the books and materials which should be about \$50.00. GWU engineering students should contact Mr. David Schnaper, phone: (202) 676-2365 or Mr. Richard Biby, phone: (703) 528-8489, co-chairmen of the GWU student chapter of the National Society of Professional Engineers, to make arrangements to take this review course. All other students and persons should contact Mr. Bruce Herbert of the Continuing Engineering Education Program at 994-6106.

# OPERATIONS RESEARCH: A Dynamic Discipline Directs New Developments

by Tom Doherty

Operations Research (OR) emerged as a discipline during the Second World War when engineers and physical scientists were called upon to solve the problem of using radar to defend Great Britain against air attack. A key part of the problem was that radar fell short of its operational requirements, and that study into the operational aspects of the system was necessary.

The use of OR in manufacturing, planning, and decision making is essential in the drive to improve U.S. productivity. OR has applications in both the public and private sector. OR is used to help solve problems in manufacturing, policy analysis, economics, planning, financial management and many other areas. OR is a dynamic discipline that crosses between and over into different subject areas. Subjects such as economics, statistics, probability, linear algebra, computer science, management, and planning are brought together in OR to help the analyst solve and understand problems and systems. OR-influenced decisions are found in the type of line you wait on at a bank, in airline schedules, in quality control, in the models used to make policy decision, and in manpower planning at the Pentagon. OR is not a field that is exclusively research, it has made its most important

contributions in the search for solutions to problems.

Like most engineering disciplines, OR owes a debt to the development of the digital computer. The solution of very large scale problems would be impossible without a computer. OR relies heavily on the computer and has contributed to the development of computer science. Linear Programming, a field within OR, was a driving force in the development of the early digital computers and was one of the first application fields for computers. The use of a Decision Support System (DSS), a combination of both data and model (OP algorithm) management tools, in business or government would be impossible were it not for computers. Artificial Intelligence (AI) and Expert Systems are areas where OR promises to make significant advances in the introduction of AI to decision makers.

OR does not concern itself with any "real" type of material, it is based on a body of knowledge useful in solving problems and defining relationships. The field of OR can be broken into two, major but not exclusive, parts. A deterministic field that finds its best illustration in Linear Programming and a stochastic side exemplified by Queuing Theory. These two general areas come together in OR by providing the basic algorithms and techniques an OR analyst uses to identify, solve and research problems or systems.

What makes a good OR analyst? Due to the great scope of sub-fields that make up OR (Decision Analysis, Modeling, Linear Programming, Dynamic Programming, Non-Linear Programming, Queuing Theory, Game Theory, and others) an OR practitioner cannot possibly be an expert in all areas. Indeed each area itself could be construed to be a separate and distinct field of study and to a large extent each one is. An OR analyst is aware of the disciplines which make up Operations Research. The analyst draws on this knowledge to identify and solve problems. OR analyst's specialize in one or more areas, but, are always aware of the possible ways to use areas outside their particular field of expertise. OR's scope of problems can be described as the following:

1) Organizational Content: changes of the people and /or equipment which make up the system, that is, addition subtraction, or modification of these resources.

2) Organizational Structure: changes in the division of labor, that is, in the assignment of activity and the responsibility for it to the subgroups of men and/or equipment.

3) Communication: changes in the generation, collection, treatment, and transmittal of information.

4) Control: changes in the way available resources are used. [Ackoff, 1963]

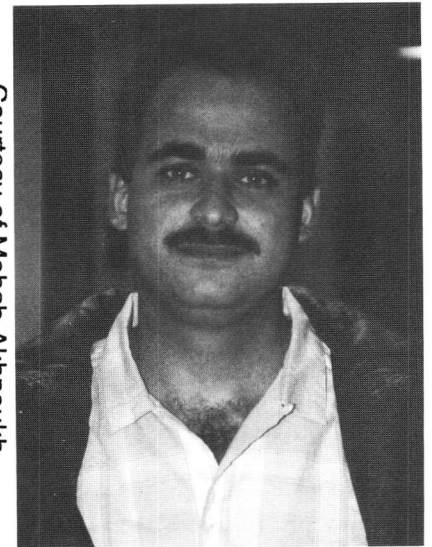
George Washington University's Operations Research department is involved in pursuing research in both the stochastic and deterministic sides of OR. Recent research has dealt with Inventory Control, Budget Modeling, Reliability, and linear and Non-Linear programming, to name a few of the many areas. GW offers a degree in Systems Analysis and Engineering at the undergraduate level and degrees in Operations Research at the

graduate level and degrees in Operations Research at the graduate and doctoral level. The faculty at GW are well known within the OR community and the former chairman Professor Gross was elected to be president of the Operations Research Society of America. His term of office begins in 1989. The OR program at GW is an excellent program that produces students ready and able to meet the challenges of an OR analyst or researcher.

The future of OR lies in refining and expanding the knowledge base which makes up Operations Research. Research is being pursued in both the discrete and stochastic areas. The integration of Expert Systems and AI in the decision making process offers the opportunity for OR to increase its already important role in decision and policy making. Among the most highly publicized areas of recent development is the interior point method of solving Linear Programs developed by N. Karmarkar at Bell Labs. This technique has already been coded by AT&T and is available for use. This algorithm shows great potential for increasing the speed at which large scale problems are solved. As OR continues to develop its knowledge base, its influence in business and public sector will continue to grow and expand. Operations Research is a discipline that will continue to find new areas of interest, new systems to understand, new applications for its knowledge and ways to solve new and different problems in an increasingly complicated business and governmental environment.



Courtesy of Mohab Akhnouk



## Shaping the Future of Our School

Living in Washington, D.C., the hub of the political world, it may come as a surprise that many engineering students are not aware of what goes on in the student government, and what it can do for them. George Washington University's political groups include the Student Association, the Residence Hall Association, the Engineer's Council, and many more. All of these organizations work toward developing some aspect of student life. One person very involved in such organizations is Zuhdi Jaouni. Zuhdi is an engineering senator in the student organization, as well as the vice-president of the Engineer's Council. As the undergraduate engineering senator, he represents over 600 undergraduate engineering students in SEAS.

Originating from Jordan, Zuhdi is a senior here at GWU, majoring in electrical engineering, with an emphasis in pre-med. He would like to one day work in medical technology, possibly in instrumentation. In the 1987-88 academic year, he served as the treasurer on the Engineer's Council.

Mr. Jaouni was very involved with the GWUSA program, concerning reduced rates on

photocopying for GWU students using Gelman Library. He did not feel that GW students should have to pay as much as visitors and guests to use the facilities at their own school. His efforts lead to the selling of photocopy cards at reduced rates to GW students only.

When asked in what ways the School of Engineering and Applied Science could be improved, he listed several. He would like to see more recruitment effort to increase the number of applications to the SEAS. He would like to see a strengthening in the relationships between faculty and students. In addition, Zuhdi feels that there is not enough differentiation between GW and non-GW students. The change in photocopying policy for GW students is just one successful step in this direction.

Along with his approach to these big programs, Zuhdi is also working on some equally important smaller programs. He wants to print a sweatshirt, with the GWU Engineering School logo that everyone saw on the cover of MECHELECIV's first issue this academic year. He assisted in reinstating the Theta Tau fraternity into the Engineer's Council. Of course, as the vice-president of the Engineer's Council, he was anxious to see at least all of the traditional events, such as the Engineer's Picnic, Ball and Olympics, continued. He feels that there could be some future revisions, such as making the ball more formal. He is also motivated to establish or continue some basic services at the Davis-Hodgkins House, including the availability of science magazines, photocopying, computers, and discount diskettes.

More important than his ideas for the engineering students, is his willingness to listen. "I would love to meet to discuss ideas with anyone. Just leave a name and number at the GWUSA office," said Zuhdi. That telephone number is 994-7100.

— by Steve Fischer

## ARABIC ROM FACILITY

Implementing a language, other than English, onto a computer is a most interesting, yet sometimes difficult task. One of the most challenging languages to implement onto a computer, because it is so inherently different from the English language in terms of characters and writing patterns, is the Arabic language. It is written and read from right to left, in comparison to most other languages which are read from left to right. In addition, the Arabic alphabet consists of 28 characters, each having four different shapes depending on the position of each character in a word. Every letter can appear alone, at the beginning, the middle, or at the end of a word. Hence, there are 112 new shapes to be encoded onto the computer. The process of implementing Arabic onto a computer invoked two different parts of the project. When integrated, an entirely different environment was created for the Arabic language.

The first part of this project was to implement the Arabic language onto a personal computer. It was required to design and save all of the different fonts for the entire alphabet. This was done by creating a character generator ROM that contained the different character fonts. The most elongated and cumbersome part of the project was programming the ROM with all of the Arabic characters. This ROM was connected in parallel to the English ROM on the Hercules Graphics Adapter (for the IBM PC/XT/AT machine). In addition, a switching inverting circuit was designed to alternate between the Arabic and English languages.

The second part of this project involved the design and

implementation of a simple text editor. It demonstrated how the character generator ROM was used to produce Arabic script. The implementation of the editor was based entirely on memory mapping techniques for the screen. Memory mapping was chosen over ROM BIOS routines because of its speed. Most of the editor was implemented in Microsoft C Version 5.0; some portions were coded in Microsoft Assembler Version 5.0.

Many problems occurred while designing this project. The most complicated was converting the displayed text to appear from the right side to the left side. The task involved changing the default screen pointers settings from left side to the right side on the IBM machine. Microsoft C routines were implemented to solve this problem. Another major problem that arose dealt with the four different shapes for each alphabet letter. There are not enough keys to accommodate for all of these characters on the English keyboard. As a solution, a memory resident routine was implemented in Microsoft Assembler code. This routine constantly monitored the characters displayed and updated the last one based on the newly entered character. An example of this would be, if the space bar were to be pressed, this would indicate that the last character to be entered before the space bar should display its end of word shape; therefore, it would replace it with the appropriate shape.

Many people made this project possible. I would like to extend a special thanks to Mr. Sunil Bhargava, Professor Schmucl Rotenstreich and Mr. John Paterela of The George Washington University, for their great contribution and effort in this project. I would also like to thank the technical support unit at Hercules Corporation.

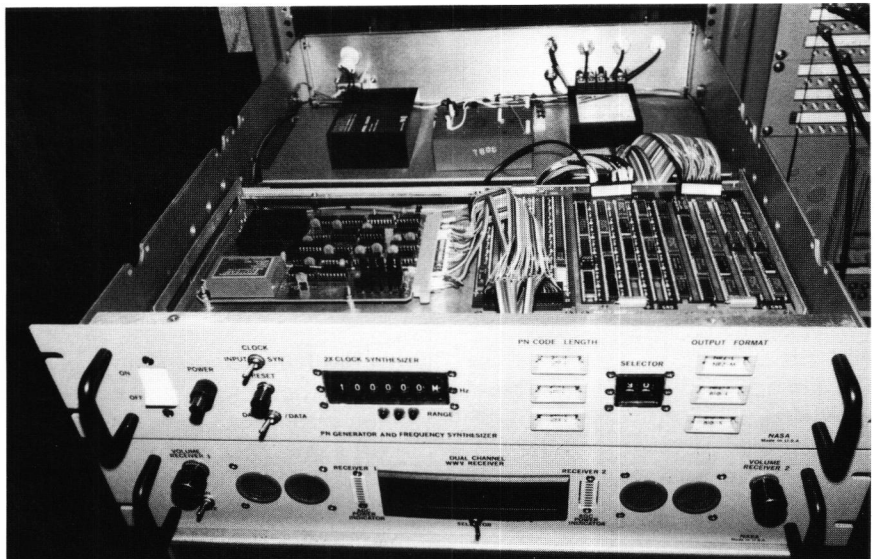
— by Sameer E. Shalaby

Sameer E. Shalaby received his B.S. degree in Computer Engineering from GWU in December 1988. His honors include Academic All-American Citation (1986), Outstanding Academic Achievement, Best Senior Design Project, and membership into the Tau Beta Pi engineering honor society and the Eta Kappa Nu Association electrical engineering honor society. His work experience includes being a computer analyst for Planning Research Corporation/NASA, computer consultant for Fullbright Alumni Association, computer assistant for Federal Highway Administration, and computer technician for the Universal Computer Company.

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## Bit Error Rate Test Set Transmitter (BERT)

A Bit Error Test Set (BERT) is used to test a communication link. The BERTS transmitter outputs a pseudo-random (PN) code that possesses an energy spectra characteristic of random data. The data, however, is not random. For a given length code, the pattern of bits is uniquely determined. PN codes are maximally long sequences generated by a bank of  $n$  shift registers with two or more of the register outputs fed back to the input of the first register, typically through a modulo-2 adder. The period of the pattern is equal to  $2^n - 1$ , where  $n$  is the number of shift register stages. If the BERTS receiver knows the length of the code it is receiving, it can generate



*The Bit Error Test Sets Transmitter (BERT) can be seen inside and out, with a on board microprocessor that generates a bit error rate and other vital statistics.*

the same code, correlate it to the received code, and count the number of bits in error.

An on-board microprocessor will then generate a bit error rate and other vital statistics. In addition to the sequence generator, John's project included a clock synthesizer (DC - 16 MHz), a code converter, and a level converter. His project is compatible with products presently manufactured by Hewlett Packard, Tau Tron, and General Data Products.

*John P. Welsh graduated from the GW SEAS in May 1988 with a degree in Electrical Engineering. For his senior project, he designed, built, and tested a Bit Error Rate Test Set Transmitter (BERT).*

*John began at the George Washington University SGBA in*

*September 1983. It was not long, however, before John saw the light and chose the path of truth; he transferred to the SEAS. There was still a gap in his educational curriculum though. The abundant theory and laboratory experience seemed to lack the purpose and direction of more deliberate career planning. John then obtained a job at NASA's Goddard Space Flight Center and enrolled in GW's co-op program, a program that is highly recommended for all. After eight semesters of academic study and two semesters of full-employment, Mr. Welsh received a B.S. degree in Electrical Engineering from the GW SEAS.*

*John presently works for the Simulations Section at the Goddard Space Flight Center, where he designs digital interfaces for mainframe and milspec computers. His project is used in the Compatibility Test Section to aid in product testing and data flows with various projects.*

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The U.S. Army Concepts Analysis Agency, CAA, located in Bethesda, Maryland, is an Army agency dedicated to the analysis of broad issues within the Army. The CAA looks at Army force structure, operational capabilities, resource requirements, logistic processes, and personnel needs, to find how to best meet the Army's present and future goals in a changing environment. In its support role to the entire Army Staff, the CAA has become recognized for its ability to incorporate the mixed military and civilian resources. Although the Agency is primarily engaged in the application of the techniques of operations research, students and graduates from all majors are needed to help accomplish the mission of the Agency. The Cooperative Education program is of particular interest at the Agency; the Agency recently received an award for the "Co-op Employer of the Year" from the George Washington University Co-op office. Students are placed in critical positions within the Agency, allowing students to gain valuable experience in the working of a highly technical government agency and giving the government a productive, highly motivated workforce.

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